

## NATURAL RESOURCES CONSERVATION SERVICE CONSERVATION PRACTICE STANDARD

### MANURE TRANSFER

(Each)

CODE 634

#### DEFINITION

A manure conveyance system using structures, conduits, or equipment.

#### PURPOSE

To transfer animal manure (bedding material, spilled feed, process and wash water, and other residues associated with animal production may be included) through a hopper or reception pit, a pump (if applicable), and a conduit to;

- a manure storage/treatment facility,
- a loading area, and
- to agricultural land for final utilization. This includes application of manure to utilization area.

#### CONDITIONS WHERE PRACTICE APPLIES

The manure transfer component is a part of a planned agricultural manure management system.

Where manure is generated by livestock production or processing; and a conveyance system is necessary to transfer manure from the source to a storage/treatment facility and/or a loading area, and/or from storage/treatment to an area for utilization.

Soils, geology, and topography are suitable for construction.

#### CRITERIA

**Regulations.** Manure transfer components shall comply with all federal, state, and local laws, rules and regulations.

**Structures.** All structures, including those, which provide a work area around pumps, will be designed to withstand the anticipated static and dynamic loading. The structure shall withstand earth and hydrostatic loading in accordance with Practice Standard 313, Waste Storage Facility. The minimum thickness of component elements of concrete structures shall also be in accordance with Practice Standard 313. When needed, covers shall be designed to support the anticipated dead and live loads.

Reception pits shall be sized to contain one full days manure production.

Openings to structures to receive manure from alley scrape collection shall be a minimum of 9 square feet with one dimension no smaller than 4 feet. The opening shall be equipped with a grate designed to support the anticipated loads.

When curbs are needed in conjunction with structures, they shall be constructed of either concrete or wood. Curbs shall be of sufficient height to insure total manure flow into the structure and be adequately reinforced and anchored.

<p>Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.</p>
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**Pipelines.** Design of pipelines shall be in accordance with Practice Standard 430, Irrigation Water Conveyance. The minimum pipeline capacity from collection facilities to storage/treatment facilities shall be the maximum flow anticipated on a daily basis. The minimum pipeline capacity from storage/treatment facilities to utilization areas shall insure the storage/treatment facilities can be emptied within the time limits stated in the management plan for manure utilization. Pipelines shall be designed to have a minimum of 2 feet per second and a maximum of 6 feet per second velocity except where ruminant manure is transferred in a gravity system; in which case velocities can be reduced if a minimum of 5 feet of head is provided on the pipe system.

Clean-out access shall be provided for gravity pipelines at a maximum interval of 200 feet for lines carrying non-bedded manure. For pipelines carrying bedded manure the maximum interval shall be 150 feet. Gravity pipelines shall not have horizontal curves or bends except minor deflections (less than 10 degrees) in the pipe joints unless special design considerations are used.

**Other Conduits.** Concrete lined ditches shall be designed in accordance with Practice Standard 428A, Irrigation Water Conveyance-Non-reinforced Concrete Ditch and Canal Lining. A minimum design velocity of 1.5 feet per second shall be used.

**Pumps.** Pumps installed for manure transfer shall meet the requirements of Practice Standard 533, Pumping Plant for Water Control. Pumps shall be sized to transfer manure at required system head and volume. Type of pump shall be based on the consistency of manure. Consideration for pump installations shall be based on manufacturer's recommendations.

**Location.** Reception pits, hoppers, manure pumps, gravity drop structures, and conduits shall be located a minimum of 100 feet from a potable water well, spring or reservoir and installed a minimum of one foot above bedrock and seasonal high water table. The design shall consider the safety of humans and animals during construction and operation. Excavation depths near or under building. The top of the drop structure shall be a minimum of five feet above the effective top elevation (top of storage minus freeboard) of

foundations should be the minimum required. Shoring and support for the foundation may be necessary to protect the building and workers during construction.

**Gravity Drop Structures.** A gravity drop structure is a vertical chute or hopper, which conveys waste into a large diameter transfer pipe. The structure shall be constructed of durable, corrosion-resistant material, and be liquid tight. The structure shall be designed to withstand all anticipated static, hydrostatic, dynamic, and earth loads in accordance with Practice Standard 313 - Waste Storage Facility. Pre-cast concrete structures shall comply with ASTM C-478 Precast Reinforce Concrete Manhole Sections.

The volume of the gravity drop structure above the maximum effective storage elevation shall be equal to or greater than the anticipated daily volume of manure produced. However, one day is recommended. The inlet or loading opening to the drop structure shall be compatible with the scraping and cleaning equipment. When manure is scraped with a front-end loader or an alley scraper system, a grate to provide the necessary opening for manure flow into the structure shall be provided. The suggested maximum slot width between the grates shall be six inches. The minimum suggested area of the grate is nine square feet with at least one dimension no smaller than four feet. The grate shall support the anticipated loads.

A cover that will support the anticipated live and dead loads and provide safety for animals and/or humans shall be provided for the drop structure. Permanent barriers such as gates, fences, etc., may be installed in lieu of a cover if such barriers insure adequate safety for human and animal traffic. Warning signs shall be posted at the drop structure to indicate the potential dangers of toxic gases.

Curbing, which is at least 12 inches high and constructed of concrete, wood, or other durable materials, may be installed across from the loading side of the grate to insure total manure flow into the drop structure. The curbing must be adequately anchored and designed against over turning forces by the scraping equipment. The drop structure inlet shall be flush with or slightly lower than the barn floor level.

the storage facility when the pipe length is less than 100 feet. The top of the drop structure shall be a minimum of six feet above the

effective top elevation of the storage facility when the pipe length is greater than 100 feet.

The outlet of the drop structure shall be constructed to minimize the head loss at the inlet of the transfer pipe. The floor of the drop structure shall slope in the direction of the outlet to provide a smooth transition from the drop structure into the conduit. A minimum slope of 30 percent (approximately 1 vertical to 3 horizontal) is suggested. Fillets to reduce sharp corners and significant losses at the pipe inlet are recommended.

The drop structure should be located in the building or enclosed to minimize freezing and drying problems. The area around the drop structure may have to be heated during cold weather to prevent manure from freezing.

**Gravity Transfer Pipes.** The transfer pipe is a conduit used to transfer manure and liquid waste by gravity from the source to a waste storage facility. The pipe must meet or exceed the requirements of the applicable standard specifications as follows:

<u>Pipe Material</u>	<u>Specification</u>
Polyvinyl Chloride (PVC)	ASTM D 3754, or ASTM F 679
Concrete	ASTM C 76
Steel	ASTM A 53, or ASTM A 134, or ASTM A 135, or ASTM A 139

All pipe shall be new, unless otherwise approved by the State Conservation Engineer. Pipe with corrugated or similar interior and asphalt coated pipe shall not be used. All pipe must have watertight couplings for the maximum anticipated head over the pipe.

Elastomeric seals or gaskets are required for PVC, steel with bell and spigot ends and concrete pipe. Gaskets shall be the type recommended by the manufacturer of the pipe. Steel pipe without bell and spigot ends shall be welded.

All pipe must withstand the earth, live-load, and dead-load pressures. The minimum earth cover over the pipe shall be four feet or insulation provided to protect against freezing.

For dairy manure, the maximum pipe length shall be 250 feet for manure with no bedding added. The maximum pipe length for manure with chopped hay or saw dust bedding shall be 150 feet. The length of the pipe can be increased to 200 feet if water is added to the manure at the inlet of the pipe. Chopped hay or sawdust bedding must be kept to a minimum to avoid plugging of the pipe. Gravity flow pipe systems are not recommended for manure with long hay or sand bedding. Where possible, the gravity pipe shall be installed on five percent slope or flatter. The maximum length of the pipe shall be reduced by 50 feet if gravity pipes are installed on slopes steeper than five percent. The maximum pipe slope shall be 12 percent.

The pipe should not have curves or bends except for minor deflections in the pipe joints. The pipe outlet invert elevation shall be at or slightly above the storage bottom. Undulation in the pipe grade shall be kept to a minimum. In locations where the pipe grade changes, the pipe shall be vented to prevent vapor lock. The outlet end of the pipe shall have sufficient cover of manure to prevent freezing during cold weather. The end section of the pipe shall be sufficiently anchored to prevent movement of the section into the storage facility. A headwall or deadman anchors may be required.

For dairy manure, the minimum pipe diameter shall be 24 or 30 inches for systems with the minimum head greater than six feet. Smaller diameter pipes may be considered if water is added and manure is agitated at the inlet of the pipe.

For swine and veal manure with no bedding, a “flush-type” system is recommended to prevent the build up of solids. The minimum diameter pipe shall be 6 inches for pipe slopes greater than 1.0 percent and ten inches for pipe slopes between 0.5 to 1.0 percent. The minimum pipe diameter for scraper type systems shall be 12 inches. The pipe should enter the manure storage facility at approximately two feet above the bottom. The maximum grade shall be 10 percent. Pipe clean outs shall be installed every 100 feet. Undulations in the pipe grade shall be kept to a minimum.

For milkhouse and parlor wastewater, the minimum pipe diameter shall be 4 inches for pipe slopes greater than 1.0 percent and 6 inches for pipe slopes between 0.5 and 1.0 percent. A settling tank (grease trap) is recommended near the inlet of the pipe to settle out solids. Pipe clean outs shall be installed every 100 feet. Undulations in the pipe grade shall be kept to a minimum.

**Gravity Outlet Pipes.** The outlet pipe is a conduit used to convey manure from the storage facility to a spreader or other hauling unit for application of manure to the field. Due to the potential hazard and management requirements, **gravity outlet pipes are not generally recommended.**

The outlet pipe shall be pressure rated. The minimum diameter shall be 18 inches. The minimum head difference (bottom of storage facility to invert of outlet end) shall be four feet. The bottom of the storage facility shall be sloped a minimum of two percent toward the inlet of the pipe. An additional depression of one foot is also recommended.

The outlet pipe shall have a minimum grade of one percent. Two shut off valves shall be installed on the pipe; one at the outlet end and one which is located below the frost line between the outlet end and the storage facility. One valve shall be operated manually and the other by another power source (ie. hydraulic). The valves must be dual acting and capable of applying pressure in both directions.

The end section of the outlet pipe shall be welded steel and shall be designed to support the anticipated horizontal and vertical loads. The outlet end of the pipe shall be high enough to load hauling equipment. A loading platform shall be constructed below the outlet and design to support the anticipated spreading equipment. A two-foot earthen berm shall be installed around the loading platform to contain any manure spilled during normal unloading operations. A pipe with a shut off valve shall be installed through the berm as an outlet.

**Reception Pits.** Reception pit is a temporary storage facility that will store manure for 3 to 14 days. The manure in a reception pit is generally transferred to the storage facility by means of PTO or electric pump.

Reception pits shall be designed and installed in accordance to practice standard 313 - Waste Storage Facility. Openings in the top or side of reception pit shall be sized and designed to accommodate both manure loading and unloading systems. Covers, grates and other protective devices shall be installed over reception pit openings. Covers and grates shall be designed to withstand anticipated live and dead loads. Grate opening shall be same as recommended for Gravity Drop Structures. Warning signs shall be posted at reception pit to indicate the potential dangers of toxic gases.

**Manure Pumps.** The pump provides mechanical energy to move manure or other agricultural waste through a transfer pipe to a storage facility. The hopper or reception pit size and dimensions shall be as recommended by the pump manufacturer. The pump shall be installed as recommended by the manufacturer. The outlet from the pump shall provide a smooth transition to the transfer pipe. Pumps and their appurtenances shall be enclosed to protect against rain and cold weather. The enclosure may also have to be heated to protect equipment from freezing. The pump enclosure shall be designed and installed in accordance to practice standard 313 - Waste Storage Facility and manufacturer's recommendations.

**Manure Pump Transfer Pipe.** The pipe used to transfer manure from a pump to a reception pit or storage facility. All pipe must have watertight couplings.

The size, type, strength and pressure rating of pipe shall meet or exceed manufacturer's recommendations. Heavier and stronger pipe shall be considered in areas where unusually high surcharges are anticipated over the pipe.

In all systems where the top of the reception pit is below the maximum operating level of the storage facilities, manually operated valves or other devices shall be installed to prevent the reverse flow of manure through the pipe and pump. Also, a corrosion resistant flap gate shall be installed at the outlet of the pipe, unless the pipe will be used for both loading and unloading of the manure storage facility. The flap gate shall be able to open more than 90 degrees and close by gravity. This shall be in addition to the check valve normally installed as an integral part of the loading pump. Valves and other devices should also be considered on all systems to allow for maintenance and repair of the reception pit, pump and other appurtenances.

**Pump Station.** A pump station is a tank, pump and other appurtenance used to collect milk house and milk parlor wastewater and transfer to a storage or treatment facility.

The minimum size tank for dairy operations with milking parlors shall be 1000 gallons. Tanks shall be installed in ground below frost elevation. If a tank cannot be installed in ground, other provisions such as insulation and supplementary heat shall be provide to prevent freezing in the tank. Tanks shall be pre-cast concrete septic type that comply with ASTM C-1227 Precast Concrete Septic Tanks. Provisions shall be made to install tanks above the seasonal high water table or designed to withstand the buoyant and other forces. Existing in place septic tanks may be used provided they are sound, in tact and meet the size requirements of the operation.

Pumps shall be submersible electric solid sewage handling type that will pump a minimum of two-inch solids. Sump pumps and effluent or chopper type sewage pumps shall not be used. Pumps and appurtenances shall

be installed in accordance to manufacturer's recommendation. Pumps shall be able to turn on and off by both float and manual switches. Pumps shall be installed to allow for easy access for maintenance and repair. Transfer pipes shall be installed in ground below frost elevation. If transfer pipe is installed above ground, the pipe shall be installed so the wastewater left in the pipe after the pump shuts off is allowed to drain freely out of the pipe. Where possible, above ground transfer pipes shall be installed through barns or other buildings. Above ground pipes should not be directly exposed to cold weather. Insulation of above ground pipes may be necessary to prevent freezing.

**Manure Stacker.** The manure stacker is an elevator that transports solid and semi-solid manure and bedding from the barn (gutter cleaner) to the storage facility. Manure stackers are not designed to handle liquid manure. The stacker shall be installed as recommended by the manufacturer. The discharge end of the manure stacker shall be suspended over the storage facility approximately one-third to one-half the total length of the facility. The support structure for the manure stacker shall be designed and installed in accordance to practice standard 313 - Waste Storage Facility and manufacturer's recommendations.

**Push Off Ramp.** A push off ramp allows manure to be loaded directly into the manure storage facility by means of front end loader or other scraping equipment.

Push off ramps shall be constructed of concrete, masonry, wood, or other approved materials. Push off ramps shall be design to withstand all anticipated static, hydrostatic, dynamic and earth loads and in accordance to practice standard 313 - Waste Storage Facility. Safety stops shall be designed and installed on all push off ramps to prevent scraping equipment from accidentally falling into the storage facility. Gates, fences, barriers, and other devices shall be installed to provide safety to humans and animals. Warning signs shall be posted at the pushoff ramp.



**Irrigation.** The irrigation of manure or wastewater shall include the pumping from the storage facility or reception pit to the field or filter area where it is applied to the land by sprinklers. Sprinkler applied manure contaminated water should normally contain less than two percent solids.

Irrigation pumps, conduits, sprinklers, and other appurtenances shall be designed, installed, maintained and operated in accordance to manufacturer's recommendation. The application of manure and wastewater shall not exceed the infiltration capacity and nutrient requirements of the soil and vegetation.

**Safety** - The system design shall consider the safety of humans and animals during construction and operation.

Open structures shall be provided with covers or barriers such as gates, fences, etc. Ventilation and warning signs shall be provided for manure transfer systems as necessary to warn of the danger of entry and to reduce the risk of explosion, poisoning, or asphyxiation.

Pipelines from enclosed buildings shall be provided with a water-sealed trap and vent or similar devices where necessary to control gas entry into buildings.

Gravity discharge pipes used for emptying a storage/treatment facility shall have a minimum of two gates or valves, one of which shall be manually operated.

Tractors or other vehicles used to tow manure spreaders or tank wagons shall be sized to reduce the danger of roll-over.

**Land Application** - Manure shall be applied to the utilization area in amounts and at a time consistent with the nutrient management plan and Practice Standard 590, Nutrient Management Plan.

Sprinklers or sprinkler systems shall be designed in accordance with Practice Standard 442, Irrigation System, Sprinkler. Sprinkler system design capacity shall be adequate to apply the required volume of manure at a rate and uniformity that shall prevent runoff and meet the nutrient needs of the plants. Nozzle size shall be appropriate for the consistency of the manure applied. Sprinkler applied, manure contaminated water, shall normally contain less

than two- percent solids unless provisions are made for straining or filtering before application.

Manure spreaders and/or tank wagons shall have adequate capacity to insure the emptying of storage/treatment facilities within appropriate time periods as stated in the system operation and maintenance plan.

Gated pipe and other appurtenances used in conjunction with gravity application shall be designed to insure uniform application amounts.

## CONSIDERATIONS

Utilization of topography to generate head to reduce pumping requirements;

Economics (including design life), overall manure management system plans, and health and safety factors;

Possible contamination of [surface water](#), domestic water systems, and ground water.

Loading and unloading of equipment in the vicinity of the manure transfer components.

Subsurface conditions, i.e., depth to bedrock, water table, etc.;

When applicable, compatibility to joint use of manure transfer with irrigation system design requirements.

System for flushing pipelines with clean water.

Provisions for cleaning out solids deposition in ditches.

Pipe pressure rating adjustments required based on manure temperature.

Corrosion resistance and water tightness in the selection of pipe material and joints;

Need for appropriate check valves, anti-siphon protection and open air breaks.

Sanitation needs of all conveyance equipment that leaves the farm in order to prevent the spread of disease.

Potential for salt (struvite) deposits in smaller diameter pipe.

[Larger diameter gravity flow pipe should be considered when the head difference is less than six feet.](#)

## PLANS AND SPECIFICATIONS

Plans and specifications for installing manure transfer systems shall be in accordance with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

## OPERATION AND MAINTENANCE

Operation and maintenance shall be in accordance with the requirements specified in the overall operation and maintenance plan required by the applicable Practice Standard 313, Waste Storage Facility, or 359, Waste Treatment Lagoon.

The protective cover or barrier for the hopper or drop structure inlet shall be maintained to provide safety for animal and human traffic. The cover or barrier shall be replaced immediately after each cleaning.

Frozen or dried manure can cause plugging of the transfer system. Frozen manure should be piled or stacked until thawed before loading into transfer system.

Shields and other safety devices on gutter cleaners, manure pumps, and other equipment shall be maintained.

Equipment operators should exercise care when loading the transfer system and unloading the storage structure to prevent damage to the system. Any damage to the system should be repaired as soon as practical. The landowner should train all persons involved in the operation of the gravity outlet system. All control valves shall be closed at the end of each day.